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REMARKS

Claims 1-5 and 7-19 are in the case and stand rejected under 35 USC § 103 over USPN 6,323,121 to Liu et al. in view of various combinations of one or more of USPN 6,365,495 to Wang et al., USPN 5,882,489 to Bersin et al., and USPN 6,133,143 to Lin et al. Claims 1, 3-5, 7, 9-12, 14, and 19 have been amended. No new matter has been introduced by the amendments, which are supported by the disclosure of the original claims and the specification. Reconsideration and allowance of the claims are requested.

CLAIM REJECTIONS UNDER §103

Claims 1, 3-5, 7, 11-12, 15, and 17-19 are rejected under 35 U.S.C. 102 as being unpatentable over Liu et al. in view of Wang et al. Independent claim 1 as amended claims a process for forming a conductive via including, *inter alia*, forming a liner layer in a deposition reactor by (i) depositing no more than about twenty angstroms of the liner layer, (ii) forming an isotropic plasma of hydrogen and nitrogen ions using a plasma source disposed upstream from the deposition reactor, (iii) flowing the isotropic plasma into the deposition reactor, (iv) exposing the liner layer to the isotropic plasma of hydrogen and nitrogen ions, thereby densifying the liner layer, including sidewalls of the liner layer, and (v) repeating steps (i) through (iv) until the liner layer is formed to a desired thickness. Liu et al., Wang et al., and their combination do not describe such a process.

Liu et al. describe a dry cleaning method for a damascene process. However, Liu et al. do not describe exposing a liner layer in a via cavity to an isotropic plasma formed in an upstream plasma source. Wang et al. do not compensate for the deficiencies of Liu et al., in that Wang et al. also do not describe the step of exposing a liner layer to an isotropic plasma of hydrogen and nitrogen ions that is formed in an upstream plasma source. Rather, Wang et al. describe forming the complete thickness of the liner layer in a single deposition step, and then processing the liner layer with a plasma that is formed in the deposition chamber.

Therefore, independent claim 1 as amended patentably defines over Liu et al. in view of Wang et al. Reconsideration and allowance of independent claim 1 are respectfully requested.

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Dependent claims 3-5 and 7 depend from independent claim 1, and contain additional important aspects of the invention. Therefore, dependent claims 3-5 and 7 patentably define over Liu et al. in view of Wang et al. Reconsideration and allowance of dependent claims 3-5 and 7 are respectfully requested.

Similar to that as described above in regard to claim 1, claim 11 also claims, *inter alia*, forming a liner layer in a deposition reactor by (i) depositing no more than about twenty angstroms of the liner layer, (ii) forming an isotropic plasma of hydrogen and nitrogen ions using a plasma source disposed upstream from the deposition reactor, (iii) flowing the isotropic plasma into the deposition reactor, (iv) exposing the liner layer to the isotropic plasma of hydrogen and nitrogen ions, thereby densifying the liner layer, including sidewalls of the liner layer, and (v) repeating steps (i) through (iv) until the liner layer is formed to a desired thickness. As described above, Liu et al. in view of Wang et al. do not describe such limitations. Therefore, independent claim 11 as amended patentably defines over Liu et al. in view of Wang et al. Reconsideration and allowance of independent claim 11 are respectfully requested.

Dependent claims 12, 15, and 17-19 depend from independent claim 11, and contain additional important aspects of the invention. Therefore, dependent claims 12, 15, and 17-19 patentably define over Liu et al. in view of Wang et al. Reconsideration and allowance of dependent claims 12, 15, and 17-19 are respectfully requested.

Claims 2 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. in view of Wang et al., and further in view of Bersin et al. Claim 2 depends from claim 1, and therefore claims *inter alia*, forming a liner layer in a deposition reactor by (i) depositing no more than about twenty angstroms of the liner layer, (ii) forming an isotropic plasma of hydrogen and nitrogen ions using a plasma source disposed upstream from the deposition reactor, (iii) flowing the isotropic plasma into the deposition reactor, (iv) exposing the liner layer to the isotropic plasma of hydrogen and nitrogen ions, thereby densifying the liner layer, including sidewalls of the liner layer, and (v) repeating steps (i) through (iv) until the liner layer is formed to a desired thickness.

The deficiencies of Liu et al. in view of Wang et al. in regard to these limitations are described at length above. Bersin et al. do not remedy these deficiencies, in that Bersin et al. also do not describe exposing a liner layer to an

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isotropic plasma of hydrogen and nitrogen ions formed in an upstream plasma source, thereby densifying the liner layer, including sidewalls of the liner layer.

Therefore, claim 2 patentably defines over Liu et al. in view of Wang et al. and further in view of Bersin et al. Reconsideration and allowance of claim 2 are respectfully requested.

Claim 16 depends from claim 11, and therefore claims *inter alia*, forming a liner layer in a deposition reactor by (i) depositing no more than about twenty angstroms of the liner layer, (ii) forming an isotropic plasma of hydrogen and nitrogen ions using a plasma source disposed upstream from the deposition reactor, (iii) flowing the isotropic plasma into the deposition reactor, (iv) exposing the liner layer to the isotropic plasma of hydrogen and nitrogen ions, thereby densifying the liner layer, including sidewalls of the liner layer, and (v) repeating steps (i) through (iv) until the liner layer is formed to a desired thickness.

The deficiencies of Liu et al. in view of Wang et al. in regard to these limitations are described at length above. Bersin et al. do not remedy these deficiencies, in that Bersin et al. also do not describe exposing the liner layer to an isotropic plasma formed in an upstream plasma source, thereby densifying the liner layer, including sidewalls of the line layer.

Therefore, claim 16 patentably defines over Liu et al. in view of Wang et al. and further in view of Bersin et al. Reconsideration and allowance of claim 16 are respectfully requested.

Claims 8-9 and 13-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. in view of Wang et al., and further in view of Lin et al. Dependent claims 8-9 depend from independent claim 1, and therefore claim *inter alia*, forming a liner layer in a deposition reactor by (i) depositing no more than about twenty angstroms of the liner layer, (ii) forming an isotropic plasma of hydrogen and nitrogen ions using a plasma source disposed upstream from the deposition reactor, (iii) flowing the isotropic plasma into the deposition reactor, (iv) exposing the liner layer to the isotropic plasma of hydrogen and nitrogen ions, thereby densifying the liner layer, including sidewalls of the liner layer, and (v) repeating steps (i) through (iv) until the liner layer is formed to a desired thickness.

The deficiencies of Liu et al. in view of Wang et al. in regard to these limitations are described at length above. Lin et al. do not remedy these deficiencies, in that Lin et al. also do not describe exposing a liner layer to an isotropic plasma of

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hydrogen and nitrogen ions formed in an upstream plasma source, thereby densifying the liner layer, including sidewalls of the liner layer.

Therefore, claims 8-9 patentably define over Liu et al. in view of Wang et al. and further in view of Lin et al. Reconsideration and allowance of claims 8-9 are respectfully requested.

Claims 13-14 depend from claim 11, and therefore claim *inter alia*, forming a liner layer in a deposition reactor by (i) depositing no more than about twenty angstroms of the liner layer, (ii) forming an isotropic plasma of hydrogen and nitrogen ions using a plasma source disposed upstream from the deposition reactor, (iii) flowing the isotropic plasma into the deposition reactor, (iv) exposing the liner layer to the isotropic plasma of hydrogen and nitrogen ions, thereby densifying the liner layer, including sidewalls of the liner layer, and (v) repeating steps (i) through (iv) until the liner layer is formed to a desired thickness.

The deficiencies of Liu et al. in view of Wang et al. in regard to these limitations are described at length above. Lin et al. do not remedy these deficiencies, in that Lin et al. also do not describe exposing the liner layer to an isotropic plasma containing hydrogen ions that is formed in an upstream plasma source, thereby densifying the liner layer, including sidewalls of the line layer.

Therefore, claims 13-14 patentably define over Liu et al. in view of Wang et al. and further in view of Lin et al. Reconsideration and allowance of claims 13-14 are respectfully requested.

Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. in view of Lin et al., and further in view of Wang et al., and further yet in view of Bersin et al. Independent claim 10 as amended claims, *inter alia*, forming a liner layer in a deposition reactor by (i) depositing no more than about twenty angstroms of the liner layer, (ii) forming an isotropic plasma of hydrogen and nitrogen ions using a plasma source disposed upstream from the deposition reactor, (iii) flowing the isotropic plasma into the deposition reactor, (iv) exposing the liner layer to the isotropic plasma of hydrogen and nitrogen ions, thereby densifying the liner layer, including sidewalls of the liner layer, and (v) repeating steps (i) through (iv) until the liner layer is formed to a desired thickness. The deficiencies of all of the cited references in regard to these limitations are described at length above.

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Therefore, independent claim 10 patentably defines over Liu et al. in view of Lin et al., and further in view of Wang et al., and further yet in view of Bersin et al. Reconsideration and allowance of claim 10 are respectfully requested.

COMBINATION OF REFERENCES

Applicants respectfully renew their assertion that the references cited do not support combining the elements as claimed in the present invention, and most especially in regard to the string of references cited against claim 10. The examiner is referred to the discussion in regard to this issue as contained in the previously filed amendment, which discussion is not repeated here.

CONCLUSION

Applicants assert that the claims of the present application patentably define over the prior art made of record and not relied upon for the same reasons as given above. Applicants respectfully submit that a full and complete response to the office action is provided herein, and that the application is now in fully in condition for allowance. Action in accordance therewith is respectfully requested.

In the event this response is not timely filed, applicants hereby petition for the appropriate extension of time and request that the fee for the extension be charged to deposit account 12-2355. If other fees are required by this amendment, such as fees for additional claims, such fees may be charged to deposit account 12-2252. Should the examiner require further clarification of the invention, it is requested that he contact the undersigned before issuing the next office action.

Sincerely,

LUEDEKA, NEELY & GRAHAM, P.C.

By: 
Rick Barnes, 39,596

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P.O. Box 1871
Knoxville TN 37901
T:1.865.546.4305
F:1.865.934.0444
RBarnes@LNG-Patent.com

56443.am2.doc